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(54) DUAL MODE MOBILE TERMINAL

MOBILES DUALMODUS-ENDGERÄT

TERMINAL MOBILE À DOUBLE MODE

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(56) References cited:
EP-A2- 1 659 699
WO-A1-2009/116007
CN-A- 1 922 793
CN-A- 101 873 382
CN-U- 201 639 571
CN-U- 201 717 941
JP-A- 2005 311 536

- **A M Niknejad: "Ladder Filter Design, Fabrication, and Measurement", , 9 October 2008 (2008-10-09), XP055123310, Retrieved from the Internet: URL:http://rfic.eecs.berkeley.edu/142/labs /filterlab.pdf [retrieved on 2014-06-13]**

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Description

Technical Field

[0001] The present invention relates to the field of communications, and particularly, to a dual-mode mobile terminal.

Background

[0002] With the advent of 3G era, mobile communications have fully come into 3G era. Currently, there are three 3G communication standards in the world, which are respectively wideband code division multiple access (WCDMA), code division multiple access 2000 (CDMA2000), and time division-synchronized code division multiple access (TD-SCDMA). TD-SCDMA is an international standard proposed by China and recognized by the International Telecom Standardization Organization, and China possesses the core proprietary intellectual property rights. Currently, China mobile TD-SCDMA network has obtained 85 MHz frequency accumulatively, which are respectively 20 MHz (1880-1900 MHz) in F band, 15 MHz (2010-2025 MHz) in A band and 50 MHz (2320-2370 MHz) in E band, wherein E band now is merely allowed to be used for indoor coverage.

[0003] However, since the current TD-SCDMA network is not mature enough, we have to face the problem that the network coverage is not comprehensive enough. In order to solve this problem, it is considered to use other networks to improve the coverage problem, and the global system for mobile communication (GSM) network is a supplement with the best cost performance. Therefore, currently, the applications of TD-SCDMA and GSM dual-mode mobile terminals are very common.

[0004] China mobile multimedia broadcasting (CMMB) employs the mobile TV reception standard STiMi autonomously developed by China. This standard is suitable for broadcast service frequencies in the range from 30 MHz to 3000 MHz, and a broadcast system which transmits multimedia signals such as TV, broadcast, data information and so on wirelessly through satellites and the ground can realize domestic roaming. CMMB is a special service of 3G applications, and due to the portability and applicability of the mobile terminal, CMMB TV has wider influence and application prospect than common TV. CMMB employs two sets of receiving systems to support U waveband (470 MHz-798 MHz) and S waveband (2635-2660 MHz) simultaneously, wherein U waveband receives signals from a ground forwarding network, and S waveband receives TV broadcast signals from satellites. Currently, mobile terminals with CMMB functions in China use U waveband.

[0005] CMMB antenna is an important constituent part of the air interface of a mobile terminal with the CMMB functions, and the function of the CMMB antenna is to complete the wireless communication between a CMMB mobile terminal and a transmitting station by receiving wireless signals from the transmitting station. The quality of the CMMB service depends to a certain extent on the performance of the CMMB antenna. Currently, the CMMB antenna commonly used in industry is external rod antenna. In the mobile telephone design, the external antenna is gradually replaced with embedded antenna. It is proven that with respect to the antenna efficiency which is the most critical electrical parameter to the application of the mobile terminal, an embedded antenna with good design can provide the same performance as the external antenna. At the same time, the requirements on a more fashionable appearance from the consumer further urge the mobile phone manufacturer to integrate the antenna inside the device. As compared to the external antenna, the embedded antenna has the same performance, better appearance characteristics and is more rigid, and therefore, the change from the external antenna to the embedded antenna has become an irreversible trend, and the embedding solution of the CMMB antenna and the application and development of the corresponding mobile terminal are also a trend.

[0006] However, the operating band of a dual-mode terminal (such as TD-SCDMA/GSM dual-mode mobile phone) is relatively wide, including bands such as GSM 900, DCS 1800, PCS 1900, TD 1.9G and TD 2.1G and so on. For reducing the interference among multiple antennas in the CMMB antenna embedding solution, improving the receiving sensitivity of the CMMB antenna, and ensuring good CMMB antenna receiving performance and so on, a reliable solution and implementation method are required.

[0007] EP 1 659 699 A2, WO 2009/116007 A1, and A M Niknejad:"Ladder Filter Design, Fabrication, and Measurement", October 9, 2008, XP055123310, retrieved from the Internet on June 13, 2014: URL:http://rfic.eecs.berkeley.edu/142/labs/filterlab.pdf provide respective technical solutions; however, the above mentioned problem still remains unsolved.

Summary

[0008] With respect to the interference problem among multiple antennas in the CMMB antenna embedding solution in the related art, the present invention provides a dual-mode mobile terminal so as to solve at least one of the above-mentioned problems.

[0009] According to the present invention, a dual-mode mobile terminal according to claim 1 is provided. Further embodiments are defined in the dependent claims.

[0010] The dual-mode mobile terminal according to the present invention includes: a China mobile multimedia broadcasting (CMMB) antenna embedded in the dual-mode mobile terminal; a CMMB protection network connected to the CMMB antenna, wherein the CMMB protection network includes: multiple stages of circuits connected successively, wherein each stage of circuit in the multiple stages of circuits is an LC series circuit or an LC parallel circuit, two ends of the LC parallel circuit are con-

nected between the stages of circuits before and after the LC parallel circuit, and one end of the LC series circuit is connected between the stages of circuits before and after the LC series circuit, and the other end of the LC series circuit is grounded.

[0011] The dual-mode mobile terminal further includes: an antenna matching network connected between the CMMB antenna and the CMMB protection network, wherein the antenna matching network includes one of the following matching circuits: a T-shaped LC circuit, an L-shaped LC circuit, a Π-shaped LC circuit, a T-shaped RC circuit, an L-shaped RC circuit, and a Π-shaped RC circuit.

[0012] The antenna matching network further includes: a transient voltage suppression (TVS) diode, with the negative electrode thereof being connected to the matching circuit and the positive electrode thereof being grounded.

[0013] The dual-mode mobile terminal further includes: a low-noise amplifier (LNA) circuit connected to the CMMB protection network.

[0014] The dual-mode mobile terminal further includes: an LNA matching attenuation network connected to the LNA circuit, wherein the LNA matching attenuation network includes an L-shaped LC circuit and a Π-shaped resistance attenuator which are connected in series.

[0015] The attenuation value of the Π-shaped resistance attenuator is greater than or equal to 2 dB.

[0016] The dual-mode mobile terminal further includes: a control network connected to the LNA circuit and configured to provide an operating voltage and a bias voltage of LNA for the LNA circuit.

[0017] The control network includes a baseband processing chip.

[0018] The CMMB antenna includes: a windingly wiring antenna body and an antenna support.

[0019] The distance between the CMMB antenna and a dual-mode antenna of the dual-mode mobile terminal is greater than a predetermined threshold.

[0020] The dual-mode mobile terminal is a time division-synchronized code division multiple access (TD-SCDMA) and global system for mobile communication (GSM) mobile terminal, the multiple stages of circuits are four stages of circuits, wherein the four stages of circuits include: two stages of LC parallel circuits and two stages of LC series circuits, wherein the two stages of LC parallel circuits resonate at DSC 1800 transmitting and TD transmitting bands, and the two stages of LC series circuits resonate at GSM transmitting band respectively.

[0021] By way of the present invention, a CMMB antenna is embedded in the dual-mode mobile terminal and a CMMB protection network is employed to effectively suppress dual-mode signals of a dual-mode mobile terminal (such as TD-SCDMA and GSM signals of a TD-SCDMA/GSM mobile phone), the interference problem among multiple antennas in the CMMB antenna embedding solution in the related art is solved, thus being able to reduce the interference to CMMB signals by radio frequency signals such as TD-SCDMA and GSM radio frequency signals.

Brief Description of the Drawings

[0022] Drawings, provided for further understanding of the present invention and forming a part of the specification, are used to explain the present invention together with embodiments of the present invention rather than to limit the present invention, wherein:

Fig. 1 is a structural schematic diagram of a dual-mode mobile terminal according to an embodiment of the present invention;

Fig. 2 is a structural schematic diagram of a dual-mode mobile terminal according to a preferred embodiment of the present invention;

Fig. 3 is a circuit diagram of an antenna matching network according to an example of the present invention;

Fig. 4 is a circuit diagram of an LNA circuit according to an example of the present invention;

Fig. 5 is a circuit diagram of an LNA matching attenuation network according to an example of the present invention;

Fig. 6 is a structural schematic diagram of an embedded CMMB antenna body according to an example of the present invention; and

Fig. 7 is a circuit diagram of a CMMB protection network according to an example of the present invention.

Detailed Description of the Embodiments

[0023] The disclosure is described below with reference to the accompanying drawings and embodiments in detail. Note that, the embodiments of the disclosure and the features of the embodiments can be combined with each other if there is no conflict.

[0024] Fig. 1 is a structural schematic diagram of a dual-mode mobile terminal according to an embodiment of the present invention. As shown in Fig. 1, the dual-mode mobile terminal includes: a CMMB antenna 1 and a CMMB protection network 2.

[0025] The CMMB antenna 1 is embedded in the dual-mode mobile terminal.

[0026] The CMMB protection network 2 is connected to the CMMB antenna 1 and includes: multiple stages of circuits connected successively, wherein each stage of circuit in the multiple stages of circuits is an LC series circuit or an LC parallel circuit, one end of the LC series circuit is connected between the stages of circuits before and after the LC series circuit, and the other end of the LC series circuit is grounded.

[0027] A CMMB antenna is embedded in the dual-mode mobile terminal and multiple stages of LC series or parallel circuits of a CMMB protection network are employed to effectively suppress dual-mode signals of a du-

al-mode mobile terminal (such as TD-SCDMA and GSM signals of a TD-SCDMA/GSM mobile phone), the interference problem among multiple antennas in the CMMB antenna embedding solution in the related art is solved, thus being able to reduce the interference to CMMB signals by multi-mode radio frequency signals.

[0028] Preferably, as shown in Fig. 2, the dual-mode mobile terminal may further include: an antenna matching network **3** connected between the CMMB antenna **1** and the CMMB protection network **2** and being able to perform matching according to different forms of antennas to realize best antenna port input standing waves and achieve effective power transmission.

[0029] During specific implementation, the above-mentioned antenna matching network **3** may include one of the following matching circuits: a T-shaped LC circuit, an L-shaped LC circuit, a Π-shaped LC circuit, a T-shaped RC circuit, an L-shaped RC circuit, and a Π-shaped RC circuit.

[0030] Furthermore, in order to realize the purpose of lightning protection, a TVS diode may be provided in the antenna matching network **3,** with the negative electrode thereof being connected to the matching network and the positive electrode thereof being grounded.

[0031] The above-mentioned preferred implementation will be described in conjunction with the example shown in Fig. 3.

[0032] Fig. 3 is a circuit diagram of an antenna matching network according to an example of the present invention. As shown in Fig. 3, the antenna matching network includes a TVS diode and an LC circuit, which LC circuit is an L-shaped circuit. During specific implementation, a T-shaped LC circuit or a Π-shaped LC circuit can also be employed, and of course, a T-shaped RC circuit, an L-shaped RC circuit, or a Π-shaped RC circuit can also be employed.

[0033] In order to meet application scenarios of different CMMB embedded antenna patterns and improve different antenna port standing waves, an LC matching circuit is connected after the antenna in this example. At the same time, in order to prevent the CMMB antenna port from thunder, the antenna matching network may also include one anti- Electro-Static discharge (anti-ESD) diode.

[0034] Preferably, as shown in Fig. 2, the dual-mode mobile terminal may also include: an LNA circuit **4** connected to the CMMB protection network **2.**

[0035] Preferably, as shown in Fig. 2, the dual-mode mobile terminal may also include: a control network **5** connected to the LNA circuit **4** and configured to provide an operating voltage and a bias voltage of LNA for the LNA circuit 4.

[0036] The above-mentioned control network may further include: a baseband processing chip (not shown in Fig. 2), that is, an operating voltage and a bias voltage of the LNA can be provided for the LNA circuit **4** through the baseband processing chip. Of course, during specific implementation, other chips can also be employed to control the operation of the LNA.

[0037] The above-mentioned preferred implementation will be described in conjunction with the example shown in Fig. 4.

[0038] Fig. 4 is a circuit diagram of an LNA circuit according to an example of the present invention. As shown in Fig. 4, the LNA circuit may consist of one LNA and a relevant resistance and capacitance device. The LNA circuit can amplify received weak CMMB radio frequency signals, which can reduce the link noise of the entire CMMB receiving system and improve the receiving sensitivity of the CMMB antenna. At the same time, Vcontrol and Vsupply are controlled by control signals transmitted from the control network which consists of the baseband processing chip of the mobile terminal, and Vcontrol and Vsupply are enabled to control the operation of the LNA only when the user uses the CMMB functions, thus reducing the energy loss of the mobile terminal and prolonging the standby time of the mobile terminal.

[0039] Preferably, as shown in Fig. 2, the above-mentioned dual-mode mobile terminal may further include: an LNA matching attenuation network **6** connected to the LNA circuit, wherein the LNA matching attenuation network **6** includes an L-shaped LC circuit and a Π-shaped resistance attenuator which are connected in series.

[0040] The LNA matching attenuation network **6** can be employed to achieve good matching between the LNA and the subsequent stage(s) of circuit(s) and effectively transmit CMMB radio frequency signals.

[0041] The above-mentioned preferred implementation will be described in conjunction with the example shown in Fig. 5.

[0042] Fig. 5 is a circuit diagram of an LNA matching attenuation network according to an example of the present invention. As shown in Fig. 5, the LNA matching attenuation network consists of an L-shaped LC circuit and a Π-shaped resistance attenuator, which can realize that the LNA operates in the range of 479-798 MHz of CMMB wideband and has a relatively ideal gain flatness and noise coefficient. At the same time, in order to avoid link self-excitation, the attenuation value of the Π-shaped attenuator shall be greater than or equal to 2 dB.

[0043] Preferably, the CMMB antenna shown in Figs. 1 and 2 receives radio frequency signals from the transmitting station and converts high frequency electromagnetic waves into a high frequency signal current. The above-mentioned CMMB antenna may further include: a windingly wiring antenna body and an antenna support. The antenna body may be made of Flexible Printed Circuit (FPC), may also be a metal steel sheet, and may also be made of other metal materials. The antenna support may be made of a non-metallic housing, and may also be a special non-metallic support.

[0044] Fig. 6 is a structural schematic diagram of an embedded CMMB antenna body pattern according to an example of the present invention. With the consideration of the wavelength of CMMB signals and the antenna resonance frequency point, the length of the CMMB embed-

ded antenna is usually about 150 mm, and due to the limit of the space of a mobile terminal (such as a mobile phone), usually a windingly wiring fashion will be employed, such as employing an S-shaped wiring manner.

[0045] Preferably, the distance between the CMMB antenna and the dual-mode antenna of the dual-mode mobile terminal shall be set as far as possible, and during specific implementation, a predetermined threshold can be preset, and the distance between the CMMB antenna and the dual-mode antenna is kept greater than this predetermined threshold. For example, the dual-mode antenna (such as TD-SCDMA/GSM antenna) of the dual-mode mobile terminal can be provided in the mobile terminal as far as possible from the CMMB antenna.

[0046] During specific implementation, the TD-SCDMA/GSM dual-mode antenna and the CMMB antenna can be provided at two ends of the mobile terminal with the farthest distance. For example, the CMMB embedded antenna is provided at the top of the mobile terminal, and the TD-SCDMA/GSM dual-mode antenna is provided at the bottom of the mobile terminal, thus reducing the interference to the CMMB embedded antenna from the TD-SCDMA/GSM dual-mode antenna, further improving the receiving sensitivity of the CMMB antenna in this embedding solution, and reducing the interference to the CMMB antenna from the TD-SCDMA and GSM signals.

[0047] It should be noted that the dual-mode mobile terminal mentioned above can be any mobile terminal which supports two modes, for example, CDMA2000/GSM mobile terminal, TD-SCDMA/GSM mobile terminal and so on.

[0048] When the above-mentioned dual-mode mobile terminal is a TD-SCDMA and GSM mobile terminal, the multiple stages of circuits may be set as four stages of circuits, and the four stages of circuits include: two stages of LC parallel circuits and two stages of LC series circuits, wherein the two stages of LC parallel circuits resonate at DSC 1800 transmitting and TD transmitting bands, and the two stages of LC series circuits resonate at GSM transmitting band respectively. The above-mentioned preferred implementation will be described in conjunction with Fig. 7.

[0049] Fig. 7 is a circuit diagram of a CMMB protection network according to an example of the present invention. As shown in Fig. 7, this CMMB protection network consists of four stages of LC series/parallel resonant circuits, specifically, two parallel LC circuits and two series LC circuits. The two parallel stages resonant at DCS 1800 transmitting and TD transmitting bands, and the two series stages resonant at the GSM transmitting band respectively. By way of these four stages of series/parallel resonant circuits, the TD-SCDMA and GSM signals of a TD-SCDMA/GSM dual-mode mobile phone can be suppressed effectively, avoiding blocking and protecting a subsequent stage of LNA. In order to achieve relatively ideal effects, the insertion loss of the CMMB protection network is required not to exceed 3 dB, and the standing wave thereof is required to be less than 2 dB. The CMMB out-of-band frequency band suppression of 470 MHz-798 MHz is required to be greater than 25 dB at GSM 900 band, greater than 20 dB at DCS 1800 band, greater than 17 dB at TD 1.9G band, and greater than 25 dB at TD 2.1 G band.

[0050] The CMMB protection network provided between the antenna port and the LNA circuit can not only reduce the interference to the CMMB signals from the TD-SCDMA and GSM radio frequency signals but can also prevent the LNA being damaged due to a large signal from the antenna port being poured into a subsequent stage of circuit.

[0051] Preferably, the above-mentioned CMMB antenna embedding solution can also be combined with an external antenna solution, to further improve the performance of the external CMMB antenna.

[0052] In summary, by virtue of the above-mentioned embodiments provided by the present invention, not only the external CMMB rod antenna can be removed from the dual-mode mobile terminal, effectively improving user experience, but also the interference among multiple antennas in the CMMB antenna embedding solution can be reduced, improving the receiving sensitivity of the CMMB antenna, and ensuring good receiving performance of the CMMB antenna.

[0053] Obviously, those skilled in the art shall understand that the above-mentioned modules and steps of the present invention can be realized by using general purpose calculating device, can be integrated in one calculating device or distributed on a network which consists of a plurality of calculating devices. Alternatively, the modules and the steps of the present invention can be realized by using the executable program code of the calculating device. Consequently, they can be stored in the storing device and executed by the calculating device, or they are made into integrated circuit module respectively, or a plurality of modules or steps thereof are made into one integrated circuit module. In this way, the present invention is not restricted to any particular hardware and software combination.

[0054] The descriptions above are only the preferable embodiment of the present invention, which are not used to restrict the present invention. For those skilled in the art, the present invention may have various changes and variations. Any amendments, equivalent substitutions, improvements, etc. within the principle of the present invention are all included in the scope of the protection of the present invention.

Claims

1. A dual-mode mobile terminal, **characterized by** comprising:

   a China mobile multimedia broadcasting "CMMB" antenna (1) embedded in the dual-mode mobile terminal;

a CMMB protection network (2) connected to the CMMB antenna (1), wherein the CMMB protection network (2) comprises: multiple stages of circuits which are successively connected to form a ladder-shaped structure, wherein each stage of circuit in the multiple stages of circuits is an LC series circuit or an LC parallel circuit, two ends of the LC parallel circuit are connected between the stages of circuits before and after the LC parallel circuit, and one end of the LC series circuit is connected between the stages of circuits before and after the LC series circuit, and the other end of the LC series circuit is grounded;
wherein the dual-mode mobile terminal is a time division-synchronized code division multiple access "TD_SCDMA" and global system for mobile communication "GSM" mobile terminal, the multiple stages of circuits are four stages of circuits, wherein the four stages of circuits comprise: two stages of LC parallel circuits and two stages of LC series circuits, wherein the two stages of LC parallel circuits resonate at DSC 1800 transmitting and TD-SCDMA transmitting bands, and the two stages of LC series circuits resonate at GSM transmitting band respectively.

2. The dual-mode mobile terminal according to claim 1, **characterized by** further comprising:

an antenna matching network (3) connected between the CMMB antenna (1) and the CMMB protection network (2), wherein the antenna matching network (3) comprises one of the following matching circuits: a T-shaped LC circuit, an L-shaped LC circuit, a Π-shaped LC circuit, a T-shaped RC circuit, an L-shaped RC circuit, and a Π-shaped RC circuit.

3. The dual-mode mobile terminal according to claim 2, **characterized in that** the antenna matching network (3) further comprises:

a transient voltage suppression "TVS" diode, with the negative electrode thereof being connected to the matching circuit and the positive electrode thereof being grounded.

4. The dual-mode mobile terminal according to claim 1, **characterized by** further comprising:

a low-noise amplifier "LNA" circuit (4) connected to the CMMB protection network (2).

5. The dual-mode mobile terminal according to claim 4, **characterized by** further comprising:

an LNA matching attenuation network (6) connected to the LNA circuit (4), wherein the LNA matching attenuation network (6) comprises an L-shaped LC circuit and a Π-shaped resistance attenuator which are connected in series.

6. The dual-mode mobile terminal according to claim 5, **characterized in that** the attenuation value of the Π-shaped resistance attenuator is greater than or equal to 2 dB.

7. The dual-mode mobile terminal according to claim 4, **characterized by** further comprising:

a control network (5) connected to the LNA circuit (4) and configured to provide an operating voltage and a bias voltage of LNA for the LNA circuit (4).

8. The dual-mode mobile terminal according to claim 7, **characterized in that** the control network (5) comprises a baseband processing chip.

9. The dual-mode mobile terminal according to claim 1, **characterized in that** the CMMB antenna (1) comprises: a windingly wiring antenna body and an antenna support.

10. The dual-mode mobile terminal according to claim 1, **characterized in that** the distance between the CMMB antenna (1) and a dual-mode antenna of the dual-mode mobile terminal is greater than a predetermined threshold.

Patentansprüche

1. Ein mobiles Doppelmodus-Endgerät, das **dadurch gekennzeichnet ist, dass** es folgende Merkmale aufweist:

eine China-Mobile-Multimedia-Broadcasting-"CMMB"-Antenne (1), die in das mobile Doppelmodus-Endgerät eingebettet ist,
ein CMMB-Schutznetzwerk (2), das mit der CMMB-Antenne (1) verbunden ist, wobei das CMMB-Schutznetzwerk (2) Folgendes aufweist: mehrere Schaltungsstufen, die aufeinanderfolgend verbunden sind, um eine leiterförmige Struktur zu bilden, wobei jede Schaltungsstufe der mehreren Schaltungsstufen eine LC-Reihenschaltung oder eine LC-Parallelschaltung ist, zwei Enden der LC-Parallelschaltung zwischen die Schaltungsstufen vor und nach der LC-Parallelschaltung geschaltet sind, und ein Ende der LC-Reihenschaltung zwischen die Schaltungsstufen vor und nach der LC-Reihenschaltung geschaltet ist und das andere Ende der LC-Reihenschaltung mit Masse verbunden

ist;
wobei das mobile Doppelmodus-Endgerät ein mobiles Time-Division-Synchronized-Code-Division-Multiple-Access-"TD_SCDMA"- und Global-System-for-Mobile-Communication-"GSM"-Endgerät ist, die mehreren Schaltungsstufen vier Schaltungsstufen sind, wobei die vier Schaltungsstufen Folgendes aufweisen: zwei Stufen von LC-Parallelschaltungen und zwei Stufen von LC-Reihenschaltungen, wobei die zwei Stufen von LC-Parallelschaltungen bei einem DSC-1800-Übertragungsband und einem TD-SCDMA-Übertragungsband schwingen beziehungsweise die zwei Stufen von LC-Reihenschaltungen bei einem GSM-Übertragungsband schwingen.

2. Das mobile Doppelmodus-Endgerät gemäß Anspruch 1, das ferner **dadurch gekennzeichnet ist, dass** es folgendes Merkmal aufweist:

ein Antennenanpassungsnetzwerk (3), das zwischen die CMMB-Antenne (1) und das CMMB-Schutznetzwerk (2) geschaltet ist, wobei das Antennenanpassungsnetzwerk (3) eine der folgenden Anpassungsschaltungen aufweist: eine T-förmige LC--Schaltung, eine L-förmige LC-Schaltung, ein Π-förmige LC-Schaltung, eine T-förmige RC-Schaltung, eine L-förmige RC-Schaltung und eine Π-förmige RC-Schaltung.

3. Das mobile Doppelmodus-Endgerät gemäß Anspruch 2, das **dadurch gekennzeichnet ist, dass** das Antennenanpassungsnetzwerk (3) ferner folgendes Merkmal aufweist:

eine Transiente-Spannungsunterdrückungs-"TVS"-Diode, wobei deren negative Elektrode mit der Anpassungsschaltung verbunden ist und deren positive Elektrode mit Masse verbunden ist.

4. Das mobile Doppelmodus-Endgerät gemäß Anspruch 1, das ferner **dadurch gekennzeichnet ist, dass** es folgendes Merkmal aufweist:

eine Rauscharmer-Verstärker-"LNA"-Schaltung (4), die mit dem CMMB-Schutznetzwerk (2) verbunden ist.

5. Das mobile Doppelmodus-Endgerät gemäß Anspruch 4, das ferner **dadurch gekennzeichnet ist, dass** es folgendes Merkmal aufweist:

ein LNA-Anpassungs-Dämpfungsnetzwerk (6), das mit der LNA-Schaltung (4) verbunden ist, wobei das LNA-Anpassungs-Dämpfungsnetzwerk (6) eine L-förmige LC-Schaltung und ein Π-förmiges Widerstands-Dämpfungsglied aufweist, die in Reihe geschaltet sind.

6. Das mobile Doppelmodus-Endgerät gemäß Anspruch 5, das **dadurch gekennzeichnet ist, dass** der Dämpfungswert des Π-förmigen Widerstands-Dämpfungsglieds größer als oder gleich 2 dB ist.

7. Das mobile Doppelmodus-Endgerät gemäß Anspruch 4, das ferner **dadurch gekennzeichnet ist, dass** es folgendes Merkmal aufweist:

ein Steuernetzwerk (5), das mit der LNA-Schaltung (4) verbunden ist und ausgebildet ist, eine LNA-Betriebsspannung und eine -Vorspannung für die LNA-Schaltung (4) bereitzustellen.

8. Das mobile Doppelmodus-Endgerät gemäß Anspruch 7, das **dadurch gekennzeichnet ist, dass** das Steuernetzwerk (5) einen Basisband-Verarbeitungschip aufweist.

9. Das mobile Doppelmodus-Endgerät gemäß Anspruch 1, das **dadurch gekennzeichnet ist, dass** die CMMB-Antenne (1) Folgendes aufweist: einen Antennenkörper mit wicklungsmäßiger Verdrahtung und einen Antennenträger.

10. Das mobile Doppelmodus-Endgerät gemäß Anspruch 1, das **dadurch gekennzeichnet ist, dass** der Abstand zwischen der CMMB-Antenne (1) und einer Doppelmodusantenne des mobilen Doppelmodus-Endgeräts größer ist als eine vorbestimmte Schwelle.

Revendications

1. Terminal mobile à double mode, **caractérisé par le fait qu'**il comprend:

une antenne de diffusion multimédia mobile de Chine "CMMB" (1) incorporée dans le terminal mobile à double mode;
un réseau de protection CMMB (2) connecté à l'antenne CMMB (1), où le réseau de protection CMMB (2) comprend: de multiples étages de circuits qui sont connectés successivement pour former une structure en forme d'échelle, où chaque étage de circuit dans les multiples étages de circuit est un circuit en série LC ou un circuit parallèle LC, deux extrémités du circuit parallèle LC sont connectées entre les étages de circuits avant et après le circuit parallèle LC, et une extrémité du circuit en série LC est connectée entre les étages de circuits avant et après le circuit en série LC, et l'autre extrémité du circuit en série LC est reliée à la terre;

dans lequel le terminal mobile à double mode est un terminal mobile à accès multiple par répartition de code synchronisée avec la répartition dans le temps "TD_SCDMA" et à système global pour communications mobiles "GSM", les multiples étages de circuits sont quatre étages de circuits, où les quatre étages de circuits comprennent: deux étages de circuits parallèles LC et deux étages de circuits en série LC, où les deux étages de circuits parallèles LC résonnent aux bandes d'émission DSC 1800 et aux bandes d'émission TD-SCDMA, et les deux étages de circuits en série LC résonnent respectivement à la bande d'émission GSM.

2. Terminal mobile à double mode selon la revendication 1, **caractérisé par le fait qu'**il comprend par ailleurs:

un réseau d'adaptation d'antenne (3) connecté entre l'antenne CMMB (1) et le réseau de protection CMMB (2), où le réseau d'adaptation d'antenne (3) comprend l'un des circuits d'adaptation suivants: un circuit LC en "T", un circuit LC en "L", un circuit LC en forme de Π, un circuit RC en "T", un circuit RC en "L" et un circuit RC en forme de Π.

3. Terminal mobile à double mode selon la revendication 2, **caractérisé par le fait que** le réseau d'adaptation d'antenne (3) comprend par ailleurs:

une diode de suppression de tension transitoire "TVS", son électrode négative étant reliée au circuit d'adaptation et son électrode positive étant reliée à la terre.

4. Terminal mobile à double mode selon la revendication 1, **caractérisé par le fait qu'**il comprend par ailleurs:

un circuit amplificateur à faible bruit "LNA" (4) connecté au réseau de protection CMMB (2).

5. Terminal mobile à double mode selon la revendication 4, **caractérisé par le fait qu'**il comprend par ailleurs:

un réseau d'atténuation d'adaptation LNA (6) connecté au circuit LNA (4), où le réseau d'atténuation d'adaptation LNA (6) comprend un circuit LC en "L" et un atténuateur de résistance en forme de Π qui sont connectés en série.

6. Terminal mobile à double mode selon la revendication 5, **caractérisé par le fait que** la valeur d'atténuation de l'atténuateur de résistance en forme de Π est supérieure ou égale à 2 dB.

7. Terminal mobile à double mode selon la revendication 4, **caractérisé par le fait qu'**il comprend par ailleurs:

un réseau de commande (5) connecté au circuit LNA (4) et configuré pour fournir une tension de fonctionnement et une tension de polarisation de LNA pour le circuit LNA (4).

8. Terminal mobile à double mode selon la revendication 7, **caractérisé par le fait que** le réseau de commande (5) comprend une puce de traitement de bande de base.

9. Terminal mobile à double mode selon la revendication 1, **caractérisé par le fait que** l'antenne CMMB (1) comprend: un corps de d'antenne à câblage par enroulement et un support d'antenne.

10. Terminal mobile à double mode selon la revendication 1, **caractérisé par le fait que** la distance entre l'antenne CMMB (1) et une antenne à double mode du terminal mobile à double mode est supérieure à un seuil prédéterminé.

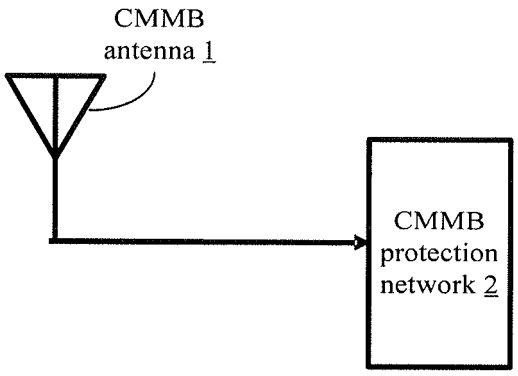

CMMB
antenna 1
CMMB
protection
network 2

Fig. 1

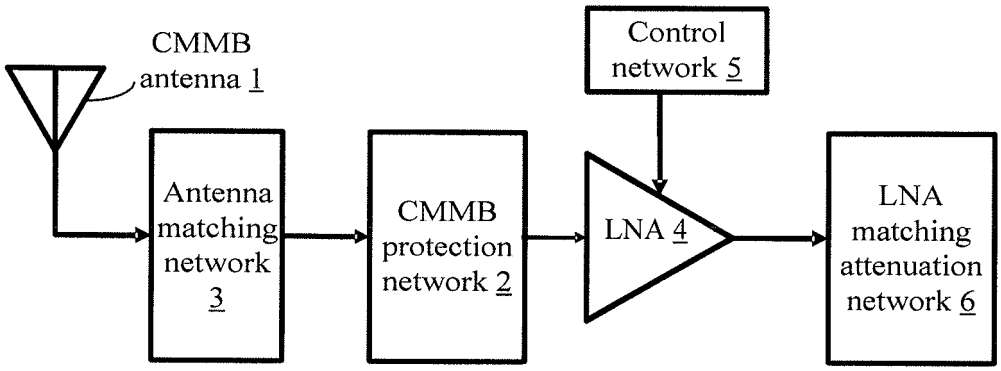

CMMB
antenna 1
Control
network 5
Antenna
matching
network
3
CMMB
protection
network 2
LNA 4
LNA
matching
attenuation
network 6

Fig. 2

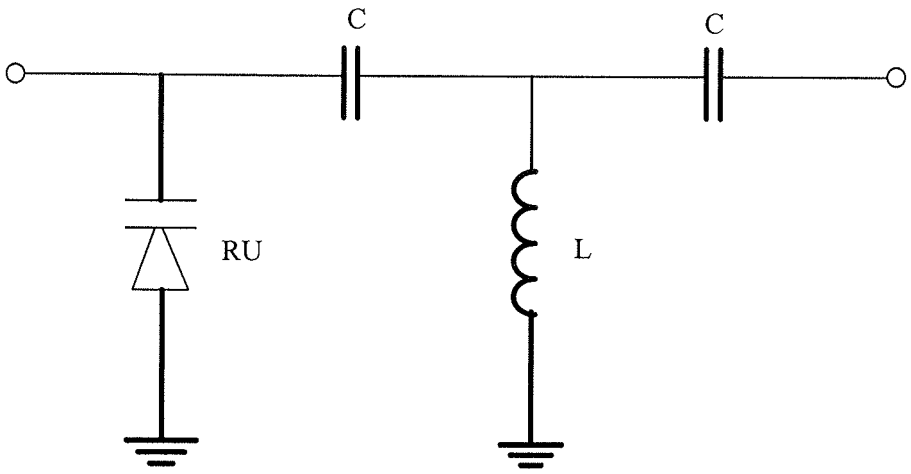


Fig. 3



Fig. 4

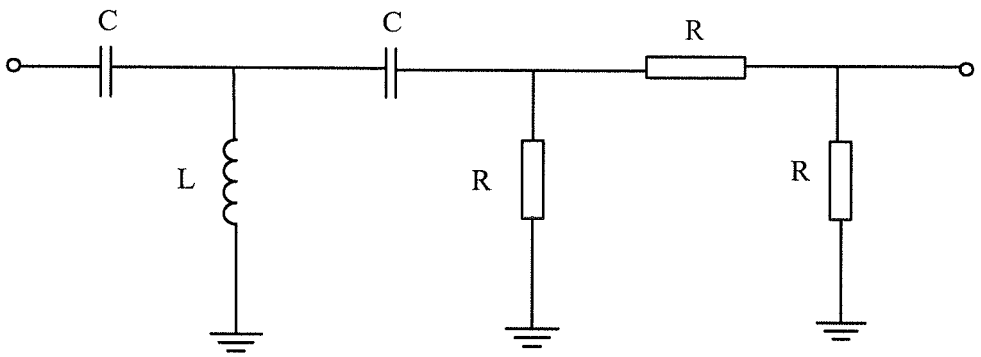


Fig. 5

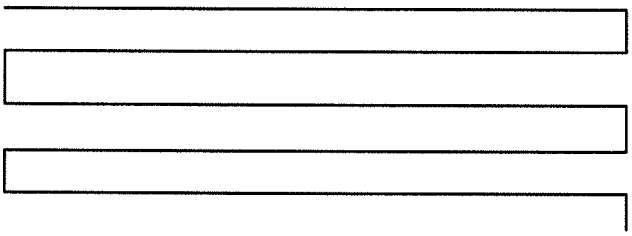


Fig. 6

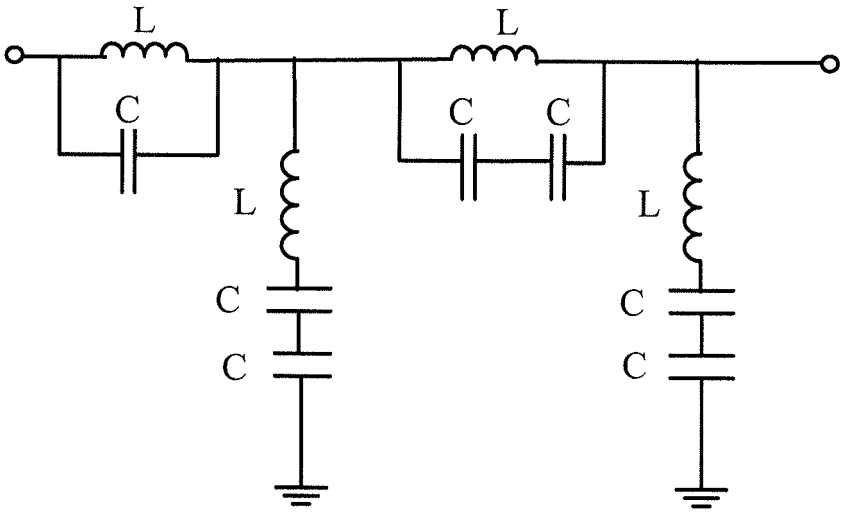


Fig. 7

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 1659699 A2 **[0007]**
- WO 2009116007 A1 **[0007]**

Non-patent literature cited in the description

- **A M NIKNEJAD.** *Ladder Filter Design, Fabrication, and Measurement,* 09 October 2008, URL:http://rfic.eecs.berkeley.edu/142/labs/filterlab.pdf **[0007]**